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REVIEW OF H. J. REICH'S BOOK: "THEORY AND APPLICATIONS OF ELECTRONIC APPARATUS"

This review by Soviet scientists evaluates an English language textbook on electronics and compares it with scientific literature available in the USSR.

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Reich has entitled his book. "Theory and Applications of Electronic Apparatus," but the title is not appropriate and does not agree with out accepted terminology.

First of all, nonvacuum electronic apparatus is not discussed at all in the book. Moreover, there is no discussion of concrete techniques in applying electronic and ionic apparatus, i.e., the working diagrams and numerical relations of various layouts with electronic and ionic apparatus; radio transmitters and receivers, rectifiers, automatic and telecontrol apparatus, high-frequency electron tube heaters, etc. In American literature the term "electronic apparatus" is a general one, while with us it applies only to apparatus with electron discharges. Consequently, the title of the book should read, "Theory of Electronic and Ionic Vaccum Apparatus and Methods for Their Technical Application."

But even this title would cover an extremely wide field and compel the author to treat in one book the fundamental theoretical material usually covered by four or five independent courses. The book would have to be an encyclopedic course on the theoretical engineering principles of the electronic and ionic vacuum apparatus mentioned above.

The author himself defines the book's scientific level and method of presenting material as follows: "Although the book was originally intended as a guide for students, it is hoped that it will prove useful as a reference book for engineers." What success the author attained will be shown later.

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A feeling of surprise and disagreement caused the editor of the translation (B. M. Tsarev) to begin his Preface by the words: "A basic position in Soviet literature is held by textbooks on the classical theory of vacuum tubes intended for students in higher technical schools, technical schools, and engineering and technical personnel in the field of electrocommunications systems. There are considerably fewer books on problems of practical application of electron tubes and their operation in systems. This is particularly true not so much for communication systems as for various fields of engineering."

Without denying that we have very good courses by V. F. Vlasov, A. A. Shaposhnikov on the theory of electronic and ionic apparatus, we also have good reason to take pride in the development of Soviet scientific literature on "problems of practical application of electron tubes and their operation in systems." Our courses on radio transmitters by A. I. Berg, Z. I. Model', I. Kh. Nevyazhskiy, and others, on amplifiers and radio receivers by V. I. Siforov, L. B. Slepyan, Voyshvillo, and others, far from being inferior to courses abroad, are superior to them. There is no doubt that scientific and technical literature in the field of electron tubes and their application, as well as the actual development of the corresponding techniques, have reached a very high level both quantitatively and qualitatively in our country.

It is, therefore, impossible to agree with the above-mentioned conclusion of the editor of the translation. It may be supposed that this conclusion was prompted by the idea that H. J. Reich's book might fill some gap in Soviet scientific-technical literature; but this is not the case.

There is better foundation for the editor's comment on the well-known fact that maximum emphasis is given in our literature to the problems concerned with applications of electronic and ionic apparatus to communications engineering, especially to radio communications, while other fields of application have been less thoroughly covered. In general, the technical requirements of such fields are less complex and can be met with simpler apparatus than that needed for radio communications. They are, consequently, of less interest to authors on these subjects. It would, doubtless, be desirable to institute new courses on such applications of electronic and ionic apparatus. Nevertheless, Reich's book does not furnish any new material of this type.

Part I begins by establishing the physical concepts and basic laws on the motion of electrons in a vacuum. This material is stated concisely and simply. The theory of thermionic emission is likewise simply stated. The author does not even touch on the influence of plate voltage on this emission and, hence, fails to explain the peculiar characteristics of oxide-coated and other "economical" cathodes. Another grave defect in this section is the lack of numerical indexes for the basic parameters of various cathodes, (efficiency, service life, etc). There is no description of carbonized thoriated cathodes, and an inadequate explanation is given of the "three-halves law" for electron current in a vacuum. No formulas are given for computing the emission currents of tetrodes and pentodes.

These are very serious defects. On the credit side, we should mention the systematic examination of the relationships between currents and voltages both in the plate circuit, and in the parallel control grid circuit. In general, this section of the book is presented more simply than in similar Soviet courses.

Part II deals with vacuum-tube amplifiers. The material is presented in a descriptive and practical manner but is not carried to the necessary conclusions. The general level is also lower than the accepted level of our textbooks for higher technical schools. Nevertheless, the large amount of practical data in this section makes it generally satisfactory and useful.

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In Part III, the author presents his material in an unusual manner, combining the problems on modulation and detection of high frequency oscillations and placing them before the section of oscillators. On the one hand, this facilitates discussion later on of the processes in generating oscillation; on the other hand, it complicates the treatment of modulation processes. Neither this section, nor any other chapter, gives any concrete instructions on practical methods of modulating radio transmitters. Although the principles of plate and grid modulation are discussed, the book contains no schematic diagrams either of plate modulation or grid modulation using modulator tubes as variable grid resistors.

The treatment of demodulation is more satisfactory; in particular, the problem of detecting frequency-modulated oscillations is not badly stated. The supplement (sections 9.27--9.30), furnished by the editor, on the principles of frequency conversion in radio equipment is worth while. The absence of a bibliography at the end of this chapter is the fault of the translators.

Part IV is better written although parts of it are open to objection. Neither the content nor the terminology of the classification of vacuum tube generators on page 461 can be considered admissible, though the effort to make such a classification is praiseworthy in itself. The use of ready-made formulas without their derivation, which makes the physical relationships somewhat unintelligible, is another defect in this section. In general, the part of this section devoted to calculations is definitely inadequate. Problems concerned with generator supply in parallel and in series are poorly analyzed. Tuning-fork stabilization of low frequencies is not even mentioned. What is said about the generation of ultra-high frequencies by magnetrons and retarding-field oscillators is too brief and, consequently, practically useless. All these defects greatly detract from the value of this section.

In Part V, Langmuir's plasma theory is not mentioned in discussing the theory of gas discharge. Individual ionic apparatus are given very unequal treatment. Very little is said about mercury rectifiers, gas-discharge tubes, or glow lamps. But very satisfactory data is given, for example, on thyratons and the principles governing their application, as well as on inverters.

Part VI deals with photocells. Here we should call attention to an important supplement by the translator, giving the basic data on Soviet photocells. This is especially useful because the rest of the practical material in this section applies to American types of photocells. The translator has also added (on page 703) a special footnote, unfortunately too short, on A. G. Stoletov's work on photoelectric effects. The mathematical analysis and numerical relationships characterizing the operation of photocells are very inadequate.

Part VII deals with problems of rectification. Unlike other authors, Reich does not consider the theory of rectification until the end of the course. The material in this section is descriptive and practical and can be used to solve practical problems in current rectification and in smoothing and regulating the rectified voltage.

Finally, Part VIII deals with electronic measurements and measuring devices. Due to the wide range covered by this subject, obvious difficulties could be anticipated in the selection of appropriate material. The selection made is not fully satisfactory; in many places the material seems haphazard and inconclusive. The classification of vacuum-tube volt-meters (page 805) is definitely unsatisfactory.

In general, the book has a number of good features as well as some serious defects.

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The translators and editor of the book deserve credit for their effort to throw at least some light on the merits of Russian scientists and the successes of Soviet industry in this field by special footnotes and supplements. However, this type of presentation is very inadequate. Although the bibliography has been translated into Russian, it is not very complete or systematic. For example, in the chapter on amplifiers it is impossible to understand the omission of the courses given by V. I. Siforov and L. B. Slepyan on radio receiving apparatus. No bibliography has been supplied in the chapter on detection and modulation.

The translators have not always employed the accepted Russian terms. There is no reason for using typically American terms or, in some case, their Anglicized forms. Thus, the translators have retained "pliotron" for the usual term "electron tube" or "vacuum tube with a purely electron discharge." They have also retained such un-Russian terminology as "a degenerative system," "steam-filled apparatus," etc. They call ignitrons "ignaytrons," although this word has no reference to the English language and is derived from the Latin "ignis" (fire) and the Greek "tronos" (apparatus). Moreover, the terminology is not consistent in all parts of the book. The use of symbols and designations is unsystematic, often haphazard. Many unnecessary foreign names, like the "Hartley Circuit," are retained.

General Conclusions

In spite of grave defects, this encyclopedic book contains much useful material for Soviet readers. The compilation of all this variegated material in a single course makes the book convenient for reference but, since the method of presentation is largely descriptive, it is as valuable from the theoretical viewpoint. In view of all its deficiencies, the book cannot be considered a complete solution to the immediate problem of providing a general course on "The Theory of Electronic and Ionic Vacuum Apparatus and Methods for Their Technical Application."

To provide a combination encyclopedic course capable of satisfying the requirements of Soviet readers with regard to the scope of the material, the nature and thoroughness of the methods employed in solving theoretical and applied problems, and the technique of presentation, the course would have to be written by a group of Soviet authors.

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